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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/748,652	12/30/2003	Geon-Ook Park	20067/OPP031475US	6900
34431	7590	03/06/2006	EXAMINER	
HANLEY, FLIGHT & ZIMMERMAN, LLC 20 N. WACKER DRIVE SUITE 4220 CHICAGO, IL 60606			TOBERGTE, NICHOLAS J	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 03/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/748,652	Applicant(s) PARK, GEON-OOK	
	Examiner Nicholas J. Tobergte	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 4, 5, 7 and 8 is/are allowed.
- 6) ☒ Claim(s) 1-3, 9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 2/21/06 have been fully considered but they are not persuasive.

The applicant argues that the examiners references for rejecting claim 1 "neither disclose nor suggest implanting oxygen ions and forming an oxide in the region of the trench to be formed prior to forming the trench".

In response, the examiner would like to bring to attention **Col 3 lines 40-49** in Kim. It states forming a field oxide by implanting oxygen ions into a field region of a surface of a semiconductor. In this embodiment, there is no mention of a trench having been formed prior to this. In Col 3 lines 33-39 Kim specifically states that the trench is formed first. For this reason, the examiner takes the position that Kim is teaching that the oxide layer can be formed before or after the trench has been made.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim (US 6,008,526) and further in view of Kao et al (US 20030170964 A1).

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Pertaining to claims 1 and 2, Kim teaches a method for forming a trench in a semiconductor device comprising:

forming a pad oxide film **2** and a silicon nitride film **4** on a semiconductor substrate **1**;

selectively etching the silicon nitride film **4** and the pad oxide film **2** on a region to be formed with a trench **Col 2 lines 28-31**;

implanting oxygen ions into the semiconductor substrate in the region to be formed with the trench **Col 3 lines 50-56**;

forming an oxide in the semiconductor substrate by reacting the oxygen ions with the semiconductor substrate through a thermal diffusion of the oxygen ions **Col 3 lines 42-48**;

forming the trench by etching the semiconductor substrate and the oxide on the region to be formed with the trench **Col 2 lines 26-31 and Fig 2B**;

forming a liner oxide film **8** on an inner wall of the trench using a thermal diffusion process **Col 2 lines 34-35**; and

forming an insulation film **10** on the liner oxide film such that the trench is filled **Col 2 lines 35-37**.

wherein an edge at which a side and a bottom of the trench intersect has a curved surface. **See Fig 2B**.

Kim fails to teach the method of claim 1 wherein the mask used in the etch is the silicon nitride film.

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Kim fails to teach the method of claim 2 wherein the substrate is comprised of a silicon substrate.

Kao teaches the use of a silicon nitride mask when etching a trench in an ion implanted semiconductor substrate. [0027-0033]. Therefore it would be obvious to one of ordinary skill in the art to apply the teachings of Kao to the process of Kim. The motivation for doing this would be to decrease the number of photoresist masking layers as well as utilize a mask that is impermeable to implanted ions such as a silicon nitride mask [0033].

Kao teaches the use of a silicon substrate [0025]. Kao discloses that silicon is a typical semiconductor substrate material, and therefor would be obvious to one of ordinary skill in the art to choose such a well known and obvious material in the art.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim (US 6,008,526) and further in view of Kao et al (US 20030170964 A1).

Kim teaches the method of claim 2, wherein, in selectively etching the oxidation blocking layer **34** and the pad oxide film **32**, a first photosensitive film pattern **36** for exposing the oxidation blocking layer on the region to be formed with the trench is formed by applying, exposing, and developing a photosensitive film on the oxidation blocking layer, and then the oxidation blocking layer and the pad oxide film exposed are selectively etched using the first photosensitive film pattern as a mask **See Fig 4A**.

Kim fails to explicitly point out that silicon nitride is an oxidation blocking layer.

Kao teaches that silicon nitride is used as an oxidation blocking layer [0033].

Therefor it would be obvious to one of ordinary skill in the art to expose the trench using a photosensitive film on the oxidation blocking layer (silicon nitride film) and the pad oxide layer, the motivation being that this is a conventional photolithography process known in the art.

Pertaining to claim 9, Kim in view of Kao teaches the method of claim 1, however they fail to particularly point out that etching the substrate and the oxide on the region to be formed with the trench at different rates. The examiner would like to point out however, that the applicant does not disclose in paragraph [0017] the specific etch parameters. Because of this, the examiner would like to state that for the most part, silicon and silicon oxide will etch at different rates depending specifically upon the etchant mixture. See Silicon Processing for the VLSI Era: Volume 1 Process Technology 2nd Edition written by Wolf and Tauber, page 675. Figures 14-15 and 14-16 show different dry etching techniques with Si and SiO₂. Notice that the rates are varying constantly with the change in the gas mixture and they only intersect at one point. Because the applicant is not specific enough in the disclosure, this constitutes as differing etch rates, and such difference is inherent.

Allowable Subject Matter

Claims 4,5,7, and 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The reason for allowance is that it is not obvious, based on the prior art, to form a second photosensitive film pattern before ion implantation that is narrower than the first photosensitive film pattern.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas J. Tobergte whose telephone number is 571-272-6006. The examiner can normally be reached on Mon - Thur 7am - 5:30pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NJT



W. DAVID COLEMAN
PRIMARY EXAMINER